

Spatial Interaction and Cultural Integration in Ethnic Settlements: A China-Context Systematic Review

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ABSTRACT

Ethnic settlements in China's minority regions offer a built-environment setting for examining how spatial relations are organized in everyday life and, under some conditions, linked to broader questions of cultural integration. Yet disagreement persists over spatial interaction, cultural integration, and their indicator systems, limiting comparability across regions and methods. Existing studies also struggle to address three issues together: how interaction relates to integration, how typologies remain comparable, and how evaluation may support settlement conservation and planning more operationally. This systematic review synthesizes Chinese- and English-language studies published between 2000 and 2025 in Web of Science, Scopus, and CNKI. WoS/Scopus retrieval was global, but only China-context studies were included in quantitative reporting and mapping; CNKI trends are reported separately to reduce misinterpretation from cross-database differences. After deduplication and screening, the review corpus consisted of a trend corpus ($n = 100$) for descriptive mapping and an analytic core ($n = 37$) for thematic synthesis. The reviewed evidence clusters around four themes: spatial interaction and behavioral pathways; cultural integration and spatial expression; settlement typology and comparability; and evaluation frameworks and indicators, especially those related to cultural sensitivity. Across the reviewed studies, spatial generative logics are most consistently linked to routine socio-spatial interaction, while claims about cultural integration remain interpretive and unevenly supported. Direct evidence remains limited for testing integration pathways, establishing transferable typologies, and validating stable indicator systems. Three priorities follow: more comparable typological criteria, clearer triangulation between spatial analysis and field-based evidence, and culturally adaptive evaluation frameworks with workable indicators and procedures.

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1. Introduction

Ethnic settlements in China's minority regions are not only residential environments but also lived cultural landscapes shaped

by the close interplay of built form, spatial organization, and everyday practice. These areas are analytically important because they provide relatively concentrated settings in which spatial interaction and cultural integration can be examined together in

built-environment terms: long-term intergroup contact, shared spatial use, and culturally mediated coordination are not abstract processes here, but materially organized features of everyday life. This makes it possible to examine how coexistence, boundary-making, and negotiated spatial order are produced and reproduced through spatial arrangements and daily practice. Many of these settlements are now undergoing conservation and development interventions, which makes them useful sites for examining how built-environment change reshapes spatial order and cultural practice.

In this review, ethnic settlements refer to villages and small towns formed either through the long-term residence of a single ethnic group or through the co-residence of multiple groups under sustained contact, where built form, spatial organization, and human–environment adaptation display recognizable ethnic-cultural characteristics (Zhang et al., 2023; Zui & Tan, 2024). Related questions have also been examined beyond the China context, especially in research on ethnic spatial proximity, multiethnic coexistence, and the spatial conditions of difference in both rural and urban settings (Berceanu et al., 2023; Rotaru et al., 2023; Crețan et al., 2023). This review does not seek to generalize beyond its China-context corpus. Its purpose is more limited: to

offer a settlement-scale, built-environment-oriented synthesis that can still inform broader comparative discussion.

To avoid using key terms too loosely, this review works with two closely related concepts. Spatial interaction refers to the observable socio-spatial organization of movement, encounter, co-use, and activity distribution within ethnic-settlement environments. In practical terms, it is identified mainly through behavioral pathways, accessibility, public-space use, and the spatial distribution of opportunities for cross-group encounter (Zhang et al., 2023). Cultural integration, by contrast, is not treated here as a single homogeneous end state, but as relatively durable forms of shared practice or coordinated spatial use that may gradually emerge through sustained interaction and, where relevant, institutional mediation (Fincher & Iveson, 2008; Wise & Velayutham, 2009). In ethnic settlements, such processes may be reflected in hybridized built form, negotiated public-space order, and forms of shared place-based identification or collective memory. These phenomena are treated here as possible indicators of cultural integration, not as direct equivalents. Figure 1 outlines this analytical relation through the three dimensions of people, space, and culture.

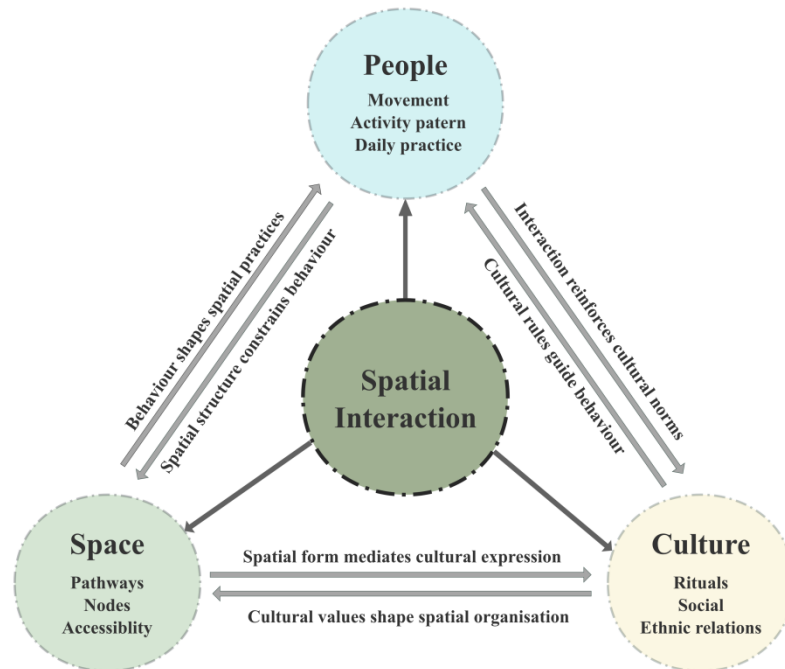


Figure 1 Conceptual framing of the relationship between spatial interaction and cultural integration in ethnic settlements.

Existing studies have produced substantial knowledge on settlement morphology, site selection and environmental adaptation, architectural and landscape characteristics, and human–environment relations, while also introducing spatial-analytic tools such as GIS-based measures and space syntax (Zhang et al., 2023; Zui & Tan, 2024). Even so, studies of spatial interaction and cultural integration still tend to proceed along separate lines. The former is more often grounded in spatial structure and morphological description, whereas the latter more

frequently relies on symbolic expression and narrative interpretation. As a result, existing studies do not yet provide a sufficiently clear basis for tracing how observable interaction is advanced into stronger claims about cultural integration, and this in turn weakens both cross-case comparison and the development of more practice-oriented evaluation (Hu et al., 2019; Yin et al., 2023).

To address these gaps, this review examines Chinese- and English-language studies published between 2000 and 2025, with

quantitative reporting restricted to China-context evidence. The analysis is organized around four linked themes—spatial interaction and behavioral pathways, cultural integration and spatial expression, settlement typology and comparability, and evaluation frameworks and indicators. The review aims to clarify how existing studies connect observable interaction, interpretive signs of coordination, typological comparison, and evaluation-oriented reasoning, while distinguishing more carefully between evidence-based synthesis and broader conceptual extension. In this way, it provides a clearer analytical basis for cross-case comparison, more cautious interpretation of claims about cultural integration, and more practice-oriented evaluation in built-environment research.

2. Methodology

2.1 Research Design and Structural Overview

This study adopts a systematic literature review (SLR) design to examine scholarship on spatial interaction and cultural integration in ethnic settlements in a transparent and reproducible manner. For coding and synthesis, the review works with four aligned themes: T1 Spatial Interaction and Behavioral Pathways, T2 Cultural Integration and Spatial Expression, T3 Settlement Typology and Comparability, and T4 Evaluation Frameworks and Indicators. Figure 2 outlines the methodological structure of the review, while detailed procedures for data sources, search strategy, screening, corpus construction, and post-screening analysis are reported in Sections 2.2–2.4.

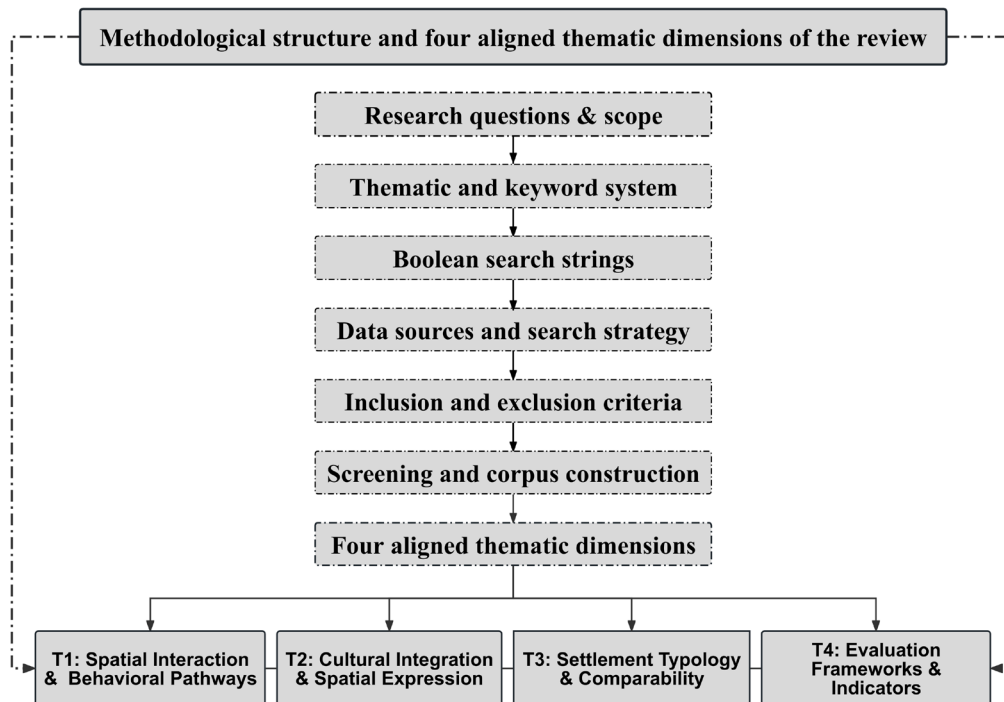


Figure 2 Methodological structure and four aligned thematic dimensions of the review.

2.2 Data Sources and Search Strategy

To balance coverage, traceability, and cross-database comparability, this review used a multi-database design. English-language records were retrieved from the Web of Science Core Collection and Scopus, while Chinese-language scholarship was retrieved from CNKI. The WoS/Scopus records entering the formal review workflow constituted the main basis for screening, corpus construction, bibliometric mapping, and thematic synthesis. By contrast, CNKI outputs were analyzed separately to describe long-run domestic publication trends and were not merged into the WoS/Scopus statistical corpus, in order to avoid distortions arising from differences in database scope, indexing practice, and metadata structure.

The retrieval window was set from January 2000 to October 2025. The start point was chosen because scholarship relevant to ethnic settlements, spatial practice, cultural landscape, and related built-environment issues became more visible and methodologically comparable after 2000 in the indexed literature. Earlier studies are relatively limited in database coverage and often lack the abstracting and keyword metadata required for reproducible retrieval and comparative coding. The endpoint of October 2025 corresponds to the latest complete retrieval round before the formal screening workflow was closed.

For WoS and Scopus, the search strategy was organized around two concept blocks: (1) settlement-related entities and (2) interaction/integration-related processes. A shared base keyword string was used across pilot and formal retrieval rounds, with field settings and syntax adjusted to database-specific requirements. The base search string was as follows: ("ethnic settlement" OR "ethnic

village" OR "minority village" OR "traditional village" OR "vernacular settlement" OR "vernacular village" OR "indigenous settlement" OR "indigenous village" OR "cultural landscape" OR "heritage settlement") AND ("spatial interaction" OR "spatial behaviour" OR "spatial behavior" OR "spatial practice" OR "cultural integration" OR "intercultural exchange" OR "community interaction" OR "social interaction" OR "social network" OR "place attachment" OR "place identity" OR "sense of place"). Terms corresponding to typology, comparability,

evaluation, and cultural sensitivity were not hard-coded into the base search string, but were instead identified during screening and coding in order to reduce false negatives. For CNKI, Chinese equivalents were combined through field settings and Boolean logic and iteratively refined through pilot retrievals. Each search round recorded the database, query version, time span, and records entering formal screening so as to maintain a traceable retrieval history. Figure 3 summarizes the overall retrieval, screening, and analysis workflow.

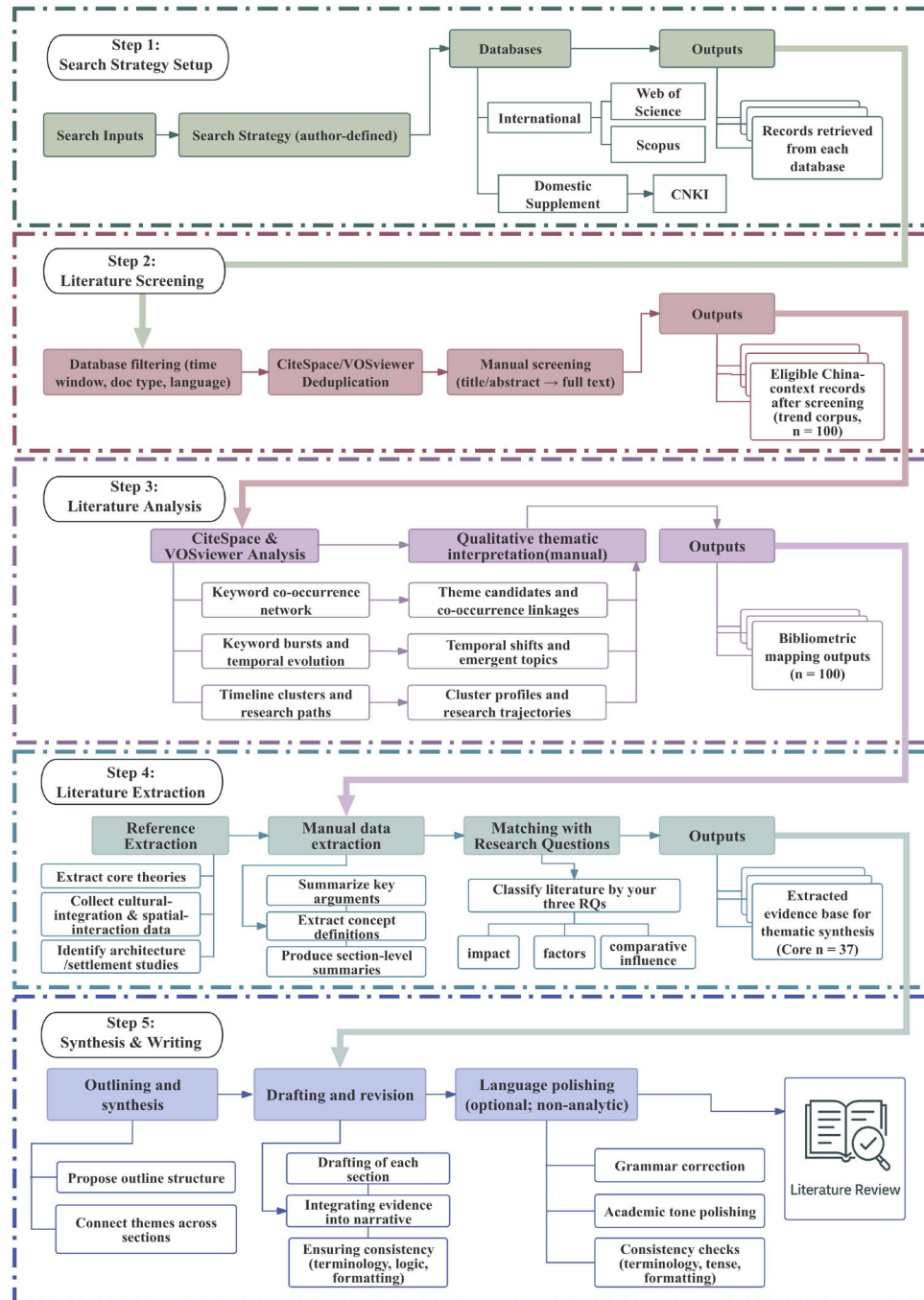


Figure 3 Overall workflow of database retrieval, screening, analysis, and synthesis.

2.3 Screening, Inclusion and Exclusion Criteria, and Corpus Construction

Screening followed established guidance for systematic reviews in the social sciences (Petticrew & Roberts, 2006; Tranfield et al., 2003) and combined database-level filtering with staged manual assessment. The review corpus was limited primarily to peer-reviewed journal articles and conference papers/proceedings. Clearly identifiable editorials, book reviews, and other non-scholarly materials were excluded at the database-filtering stage and, where necessary, during manual screening. The staged process described here was applied to WoS/Scopus records, whereas CNKI records were handled separately for descriptive trend comparison and were not entered into the screened review corpus. WoS and Scopus records were then merged and deduplicated using CiteSpace and VOSviewer, with ambiguous cases resolved by direct inspection.

Inclusion criteria (all required):

- (1) The primary object is a traditional settlement in an ethnic region, a multi-ethnic rural community, or a village/small town with salient ethnic-cultural attributes;
- (2) The study addresses at least one of the four analytical themes—spatial interaction and behavioral pathways, cultural integration and spatial expression, settlement typology and comparability, or evaluation frameworks and indicators—and explicitly relates it to spatial interaction and/or cultural integration;
- (3) Methods are described in sufficient detail to enable methodological appraisal; and
- (4) The work is published as a peer-reviewed journal article or conference paper.

Exclusion criteria:

- (1) The focus is not on spatial interaction or cultural integration at the settlement scale, such as macro-level policy discussion, generic tourism promotion, project publicity, or purely descriptive planning proposals;
- (2) Methodological description or empirical grounding is insufficient for appraisal;
- (3) The study does not fall within the China-context scope adopted for the WoS/Scopus trend corpus and thematic synthesis; or

- (4) The document is non-peer-reviewed, such as news reports, policy commentary, consultancy documents, or technical bulletins.

Given the heterogeneity of research designs and data sources, methodological appraisal was implemented as a minimum reporting threshold rather than a weighted scoring system. At this stage, the appraisal focused on whether a study reported its data sources, analytical procedures, and evidential basis with sufficient clarity to support review. Particular attention was paid to whether the evidential basis of a study was reported with sufficient clarity to make the link between evidence and claims reviewable, regardless of whether this took the form of maps, metrics, field observations, interview material, or other documentable case-based sources. Studies that did not meet this threshold were treated as methodologically unassessable and excluded from the analytic core.

Screening proceeded in three stages: (i) preliminary identification, including interface-level refinement and title, keyword, and abstract screening; (ii) full-text screening against the eligibility criteria; and (iii) threshold-based methodological appraisal. Formal retrievals were first conducted in Web of Science Core Collection and Scopus using fixed database-specific search fields, the finalized query string, and a shared time window of 2000–2025. This yielded 172 records in WoS and 491 in Scopus, for a total of 663 retrieved records. At the preliminary identification stage, interface-level refinement using available country/region information identified 74 and 124 China candidate records in WoS and Scopus, respectively, yielding 198 candidate records in total. These were then merged and deduplicated, leaving 144 unique records after 54 duplicates were removed. Titles, keywords, and abstracts were then checked manually, with full texts consulted where necessary, to confirm whether the empirical setting or primary dataset was located in China. Through this process, 100 studies were retained as the WoS/Scopus China-context trend corpus for bibliometric mapping. A further round of full-text thematic screening and threshold-based methodological appraisal excluded 63 records, yielding an analytic core of 37 studies for thematic synthesis. Because a single record could meet more than one exclusion criterion at the full-text stage, the 63 exclusions are reported as a single full-text reduction rather than as separate non-overlapping counts by reason. Figure 4 summarizes this staged screening chain and corpus structure.

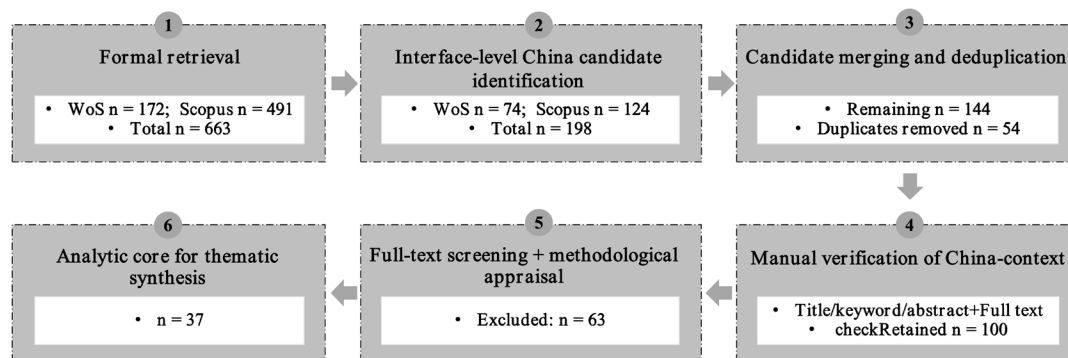


Figure 4 Staged screening process and corpus construction for the WoS/Scopus China-context review corpus.

2.4 Data Processing and Analytical Strategy

After corpus construction, the WoS/Scopus China-context trend corpus ($n = 100$) was used for bibliometric mapping, while the analytic core ($n = 37$) was used for full-text extraction and thematic synthesis. Annual publication trends are reported separately for the WoS/Scopus trend corpus (Figure 5) and the CNKI corpus (Figure 6). The primary thematic distribution of the analytic core is summarized in Figure 7, and the cross-theme synthesis is presented in Table 1. Together, these materials provide the descriptive and analytical basis for the subsequent review.

After screening, bibliographic metadata, especially author keywords, were standardized by merging synonyms, harmonizing

variants (e.g., singular/plural forms), and aligning Chinese–English terminology. The analysis combined bibliometric mapping with thematic coding. The trend corpus ($n = 100$) was used in CiteSpace and VOSviewer to generate keyword co-occurrence networks, burst detection, and timeline/cluster views. The analytic core ($n = 37$) was then subjected to iterative full-text reading and coding against a predefined thematic framework, producing a standardized evidence base for cross-study comparison. Table 2 summarizes the coding framework, focus-area keywords, and coding cues. Together, these analytical steps provide the basis for the descriptive results and thematic synthesis presented in Section 3.

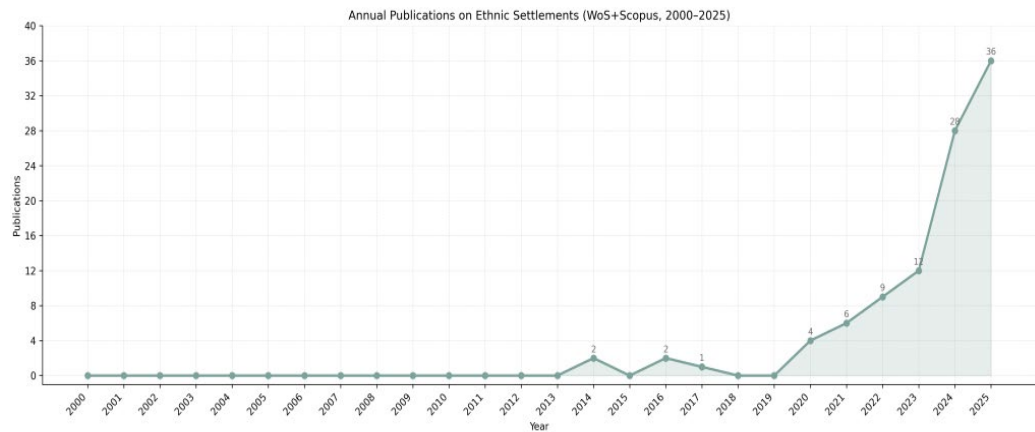


Figure 5 Annual China-context publications indexed in WoS Core Collection and Scopus (2000–2025) after deduplication and screening (trend corpus, $n = 100$).

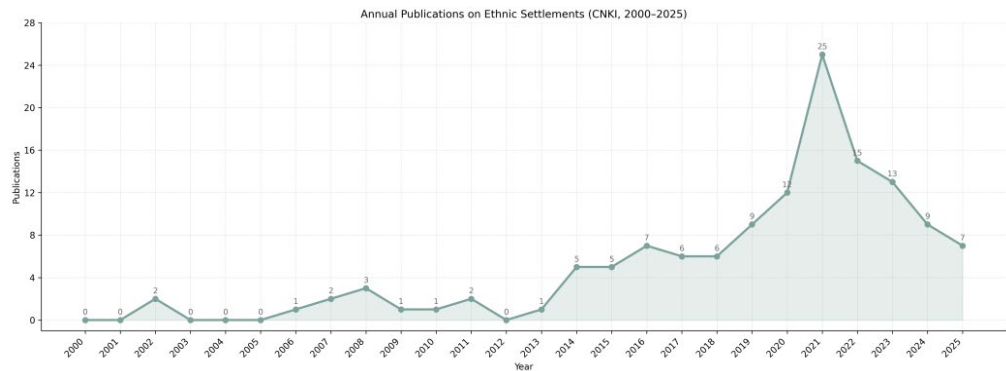


Figure 6 Annual Chinese-language publications on ethnic settlements and related topics indexed in CNKI (2000–2025).

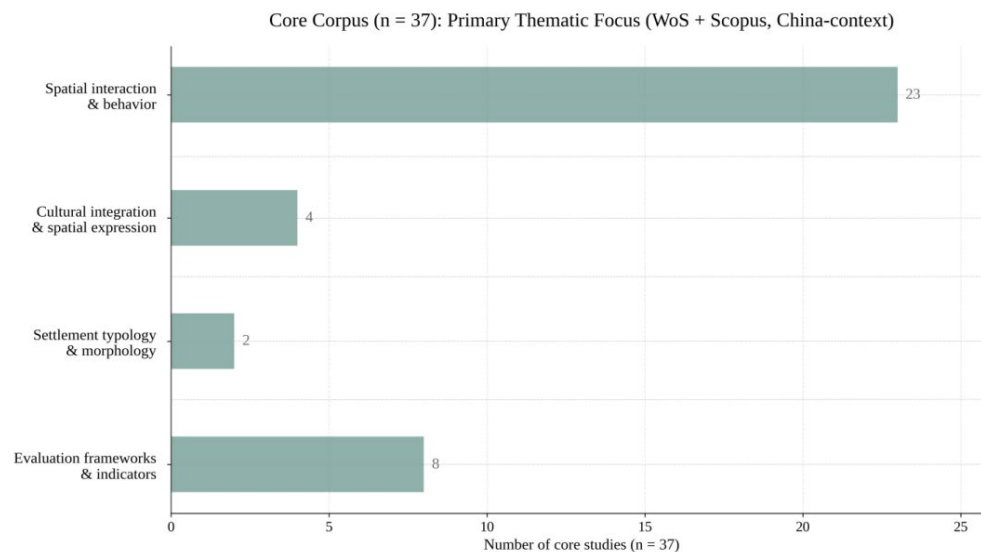


Figure 7 Primary thematic distribution of the analytic core (Core n = 37).

Table 1 Cross-theme synthesis of research foci, typical evidence/methods, key insights, and actionable gaps in the analytic core (Core n = 37).

Primary theme	n (%)	Research focus	Typical evidence / methods	Key synthesis	Actionable gaps
Spatial Interaction & Behavioral Pathways	23 (62.2)	How spatial structure and place attributes shape encounters, use, participation, and attachment	Field observation; surveys; activity/behavior mapping; place attachment/sense of place models; occasional social/network analysis	More accessible and activity-supportive settings tend to align with higher interaction intensity, participation, and attachment	Cross-ethnic interaction is often weakly operationalized; interaction→integration pathways are rarely tested; limited cross-case comparability
Cultural Integration & Spatial Expression	4 (10.8)	How cultural negotiation and identity are expressed through symbols, practices, and forms of shared spatial use	Interpretive case studies; interviews; cultural landscape/heritage framing; semiotic/textual readings	Cultural integration is more often interpreted through negotiated practice and meaning than through formal hybridity alone	Indicator development and validation remain limited; “degree” and “direction” of integration are seldom measured consistently
Settlement Typology & Comparability	2 (5.4)	How networks, spatial hierarchy, and form types condition interaction opportunities	Morphological and spatial-structural analysis; mapping-based comparison; limited configurational approaches	Morphology functions as a structural precondition enabling or constraining everyday interaction and public life	Weak coupling with observed behavior; typological schemes lack transferable criteria and reuse standards
Evaluation Frameworks & Indicators	8 (21.6)	Translating evidence on interaction, cultural expression, and settlement conditions into operational indicators for planning, conservation, and governance	Indicator construction and weighting (e.g., AHP/entropy/TOPSIS-type workflows); case validation	Frameworks improve decision readability, but results are sensitive to construct definition and indicator selection	Loose links to mechanism theory; limited cross-regional/ethnic validity testing; causal relations among indicators often unspecified

Figure 8 Keyword co-occurrence network of WoS–Scopus publications on ethnic settlements, spatial interaction and cultural integration.

3.1.2 Burst terms and temporal emphases

To identify shifting emphases over time, this study used CiteSpace to detect burst terms in the WoS–Scopus China-context trend corpus. Figure 9 reports the 13 strongest burst keywords and their active intervals across 2014–2025. The burst profile indicates a broad shift from place meaning and perception toward more practice-facing concerns, including participation, change, governance, and network-oriented analysis.

In an initial phase (approximately 2014–2016), burst activity centers on place meaning and perception, including sense of place (2014–2015), place attachment (2014–2018), and place identity (2014–2024), alongside cultural integration (2014–2023). A

middle phase (approximately 2016–2022) extends this profile toward tourism- and value-related framings, including sustainable tourism (2016–2021), cultural ecosystem services (2016–2022), and spatial identity (2016–2018). In a later phase (approximately 2018–2025), burst terms point more clearly to process- and practice-oriented concerns: place dependence (2018–2021), land use change (2020–2021), and landscape heritage (2021–2023) indicate stronger attention to change and heritage, while community participation (2021–2025), traditional village (2022–2025), and social network analysis (2020–2025) reflect growing interest in governance, intervention, and relational analysis. These phases overlap, but together they suggest a movement from perceptual constructs toward more operational and mechanism-oriented concerns.

Top 13 Keywords with the Strongest Citation Bursts

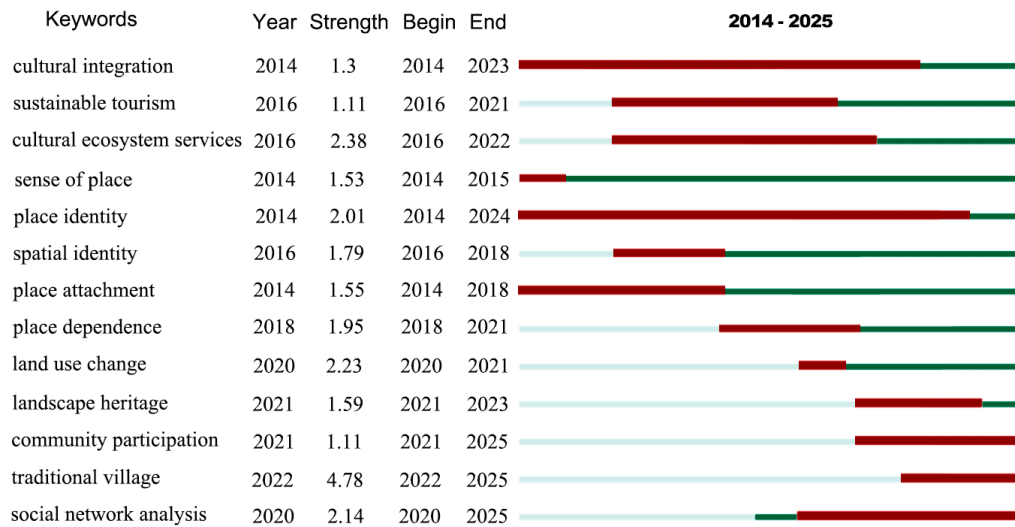


Figure 9 Top 13 keywords with the strongest citation bursts and their active intervals in the WoS–Scopus China-context trend corpus.

3.1.3 Timeline clusters and research paths

Figure 10 presents the timeline cluster view of major keyword themes in the WoS–Scopus China-context trend corpus. Read in terms of the relationships among clusters, and interpreted as research pathways, three broad tendencies can be identified.

The first tendency is oriented toward place-based evaluation. In this stream, attention to attachment, dependence, identity, and perceived change is linked to more evaluative and impact-facing concerns, suggesting a line of inquiry that moves from experiential relations with place toward questions of assessment and change. The second tendency connects heritage, culture, and village practice. Here, the clustered themes bring together discussions of

cultural integration, participation, spatial pattern, and village-based contexts, indicating a research direction concerned with how cultural meaning, spatial form, and everyday practice are read together in settlement studies. The third tendency is oriented toward networks and governance. In this stream, relational and coordination-related vocabularies point to a more mechanism-oriented line of inquiry, in which interaction structure is increasingly discussed in relation to governance and collective action. Within this broader grouping, landscape identity can be read less as a fully separate stream than as a bridging theme that connects representational concerns to the other tendencies. This clustered pattern provides an interpretive basis for the thematic synthesis that follows, where these intersecting tendencies are examined more directly through evidence on interaction, integration, typology, and evaluation.



Figure 10 Timeline clusters of major keyword themes in the WoS–Scopus China-context trend corpus.

3.2 T1 Spatial Interaction and Behavioral Pathways

Building on Section 3.1, this section synthesizes empirical studies in the China-context corpus to summarize major approaches to spatial interaction and behavioral pathways in ethnic settlements. Existing studies commonly treat settlements as composite settings shaped jointly by spatial configuration, everyday practice, and cultural logics. At the macro level, site selection and overall layout are discussed in relation to terrain and hydrological conditions; at the micro level, routes, nodes, and ritualized movement lines organize recurring encounters, circulation, and collective practices (Liu & Chen, 2022; Xin, 2022; Zhang & Wu, 2024). This line of research emphasizes that visible spatial arrangements, such as building layouts and circulation networks, are often read alongside embedded logics, including beliefs, symbols, and customary norms, showing how interaction settings are both spatially organized and culturally conditioned (Huang & Sun, 2022; Zhang & Wu, 2024).

Across cases, interaction pathways are not entirely incidental but display several recurrent configurations. Figure 11 summarizes comparative forms of spatial organization and schematic pathway types drawn from the reviewed cases. To support cross-case comparability, Table 3 organizes the synthesis into three analytic fields: key interaction nodes, dominant pathway configuration, and embedded cultural mechanisms. The five pathway types shown in Figure 11b are intended as schematic summaries of recurrent

configurational relationships rather than as an exhaustive classification, while Table 3 presents these patterns in a more comparable analytic form.

More specifically, three recurrent modes of pathway organization are especially evident. A core-clustered pathway may take circular-radial or radial-clustered forms, in which interaction is organized around communal or ritual nodes and reinforced by centrality and hierarchical ordering that support ceremonies and collective gatherings (Jiang et al., 2023; Yang et al., 2023). A terraced-mountain pathway corresponds to the vertical-terraced configuration in Table 3: vertical layering and slope-following circulation, together with stilt-house platforms and stepped paths, shape everyday mobility and ritualized movement lines, making terrain, architecture, and path structure important structural conditions for interaction (Huang & Sun, 2022). An axial or linear-corridor pathway is associated with configurations such as linear axis-street-alley systems and axial symmetry. In these settings, movement and activity tend to concentrate along principal axes and alley networks. In some water-oriented settlements, these corridors also overlap with waterfront axes, so that livelihood-related circulation becomes intertwined with culturally patterned mobility (Zheng, 2023). Methodologically, studies in this strand often combine a space-behavior interaction perspective with space syntax and morphological or pattern-language-informed spatial readings, relating movement lines to measurable accessibility and centrality indicators as well as perceptions of place meaning (Liu &

Chen, 2022; Lai et al., 2023; Zhang & Wu, 2024). In addition, quantitative layout studies from the core-37 set provide more reusable configurational measures, helping move pathway descriptions toward more comparable spatial indicators across cases (Luo et al., 2025).

Taken together, the studies reviewed here most directly substantiate how interaction is spatially organized, repeated, and stabilized in ethnic-settlement environments. What this evidence supports most clearly is the socio-spatial structuring of encounter, mobility, and recurring co-use. By itself, however, such evidence

does not establish cultural integration. Rather, it provides the empirical basis for distinguishing among three related but non-equivalent conditions: cultural coexistence, which refers to relatively stable adjacent or shared use without implying deeper convergence; spatial expression, which refers to the material, configurational, or organizational forms through which coexistence, coordination, or negotiated use become visible; and cultural integration, which refers to more durable cross-group coordination in practice, spatial order, or shared public routines. In this sense, spatial interaction is treated here as a foundational socio-spatial process, not as automatic proof of integration.

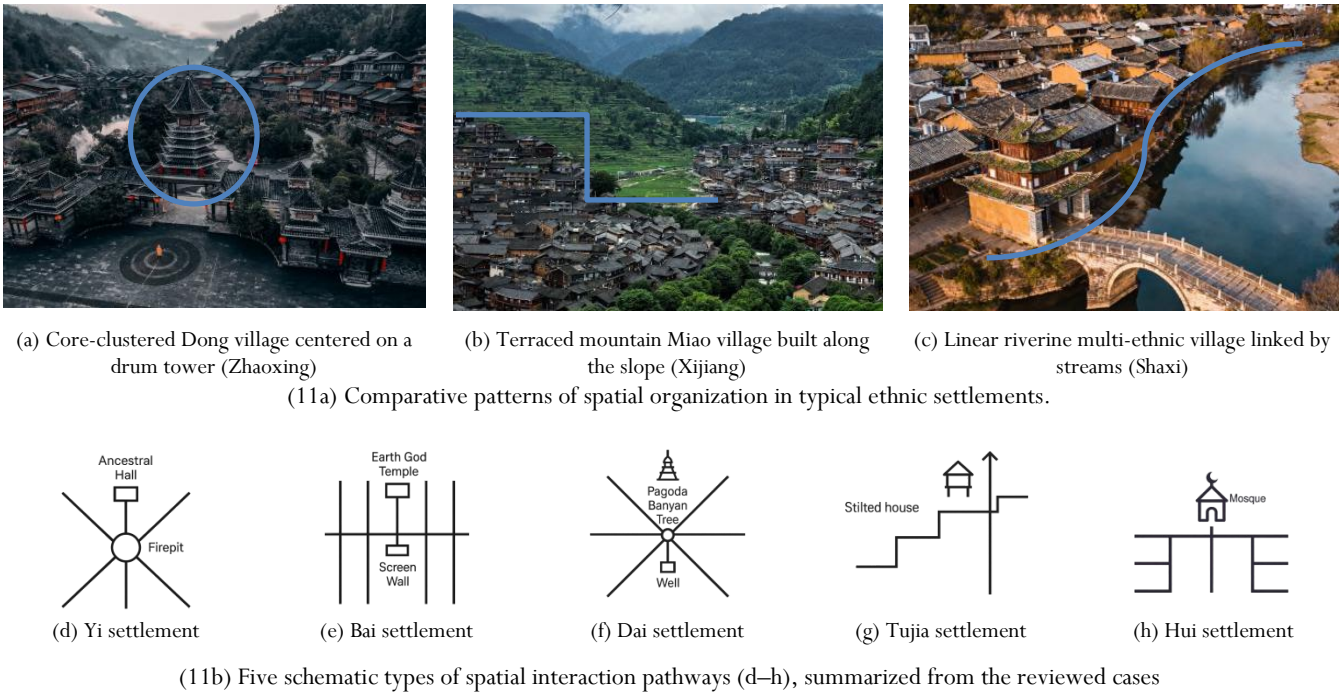


Figure 11 Spatial interaction pathway patterns and schematic types in ethnic settlements.

Table 3 Characteristics of Spatial Interaction Pathways in Selected Ethnic Settlements.

Ethnic Group	Representative Region/Village	Key interaction nodes	Dominant pathway pattern	Typical behavioral features	Embedded cultural mechanisms
Yi	Meigu, Sichuan	Firepit, Ancestral Hall	Circular + Radial	Clan gatherings, ancestor rituals	Firepit as center of power
Bai	Dali, Yunnan	Earth God Temple, Screen Wall	Linear axis + Street Alley	Neighborhood interaction, alley rituals	Segmentation of family compounds by screen walls
Dai	Xishuangbanna, Yunnan	Pagoda, Banyan Tree, Well	Radial + Clustered	Water-related group paths	Water culture and Buddhist spatial logic
Tujia	Enshi, Hubei	Stilt-house platform, rice-milling yard	Vertical + Terraced	Male–female segregation, public discussions	Clan hierarchy and sacred land beliefs
Hui	Yinchuan, Ningxia	Mosque, Square	Axial symmetry	Pilgrimage-oriented collective movement	Islamic behavioral norms and space ritualization

3.3 T2 Cultural Integration and Spatial Expression

This section examines how interaction and coexistence in ethnic settlements become materially and organizationally expressed in space. In the reviewed literature, these expressions are most often discussed through settlement morphology, architectural form, spatial layout, and circulation patterns. At the settlement scale, they typically appear through everyday coordination, shared use, and patterned spatial negotiation rather than through formal institution-led programs. Existing studies suggest that they may be observed in mixed decorative vocabularies, shared layouts, and interwoven festive or ritual routes (Zhou et al., 2023; Wang, 2023; Ling, 2020). Research on multi-ethnic traditional villages and cultural landscapes further indicates that natural conditions, historical institutions, and inter-ethnic contact can jointly shape hybridized spatial expressions at broader regional scales (Liu et al., 2025; Yang et al., 2024; Mao et al., 2025).

At the level of material form and architectural composition, these expressions are most often discussed through three related kinds of evidence: juxtaposition within shared visual fields across corridor settings, hybridization within regional vernacular traditions, and selective incorporation in village housing. In the Gan-Qing corridor, buildings associated with different groups—including temples, ancestral halls, and dwellings—may appear within the same visual field, creating layered symbolic landscapes rather than a single, uniform cultural order (Zhou et al., 2023). In western Sichuan Tibetan areas, roof forms, structural details, and painted decoration may likewise show hybrid tendencies in which religious symbolism intersects with secular aesthetics (Ling, 2020). At the village scale, evidence from Gaoli Village shows that local timber-framing logics are retained while motifs and color schemes incorporate references to neighboring groups and Han culture, producing domestic spaces marked by symbolic co-presence (Wang, 2023). Method-oriented approaches, such as landscape-gene analysis and parameter-based systems, complement these observations by offering a more systematic way to identify how cultural features are retained, recombined, and made visible in built form (Hu et al., 2024).

At the level of spatial layout and circulation patterns, relevant studies point to shared nodes and overlapping routes as recurring

forms of spatial expression. Public nodes such as pagodas, wells, markets, and old trees may be used across groups, while lineage-based ritual routes can partially coincide with tourist circuits or production paths. Studies from Qiandongnan suggest that the relationship between cultural landscape conservation and socioeconomic development may be inferred from boundary expansion, facility insertion into existing fabrics, and the reorganization of circulation systems (Yang et al., 2024; Mao et al., 2025). Quantitative layout characterization likewise offers more reusable metrics for comparing how node-path structures are configured and reorganized across cases (Luo et al., 2025).

Drawing on prior studies and typical cases, this review summarizes five recurrent pathways through which spatial expressions associated with cultural integration are reported in the literature (Figure 12): (1) architectural-form integration, including structural patchwork and mixed decorative vocabularies; (2) spatial-layout integration, including shared central nodes and intertwined ritual or everyday routes; (3) symbolic-system integration, including combined totems and mixed colors or patterns; (4) behavioral-path integration, including staggered or rotational use of shared spaces during festivals or markets; and (5) shared institutional mechanisms, including negotiated space-use agreements and governance arrangements grounded in functional complementarity (Zhou et al., 2023). Figure 12 is therefore best understood as an evidence-informed analytical synthesis of recurrent expressions identified in the reviewed studies, rather than as a validated typology.

Taken together, these studies show that interaction and coexistence in ethnic settlements leave visible traces in form, layout, symbolism, and negotiated routines. Spatial expression therefore serves as an intermediate analytical layer between evidence on interaction and stronger interpretations of cultural integration. Its evidential force is not uniform: mixed forms, shared layouts, symbolic overlap, and negotiated arrangements are better understood as graded signs of coordination and coexistence. Only when such expressions are recurrent and tied to relatively durable public routines or stabilized spatial order do they support a stronger interpretation in terms of cultural integration. Cultural integration in ethnic settlements is therefore better understood as a cumulative process of coordination, accommodation, and symbolic interweaving than as a simple layering of separate elements.

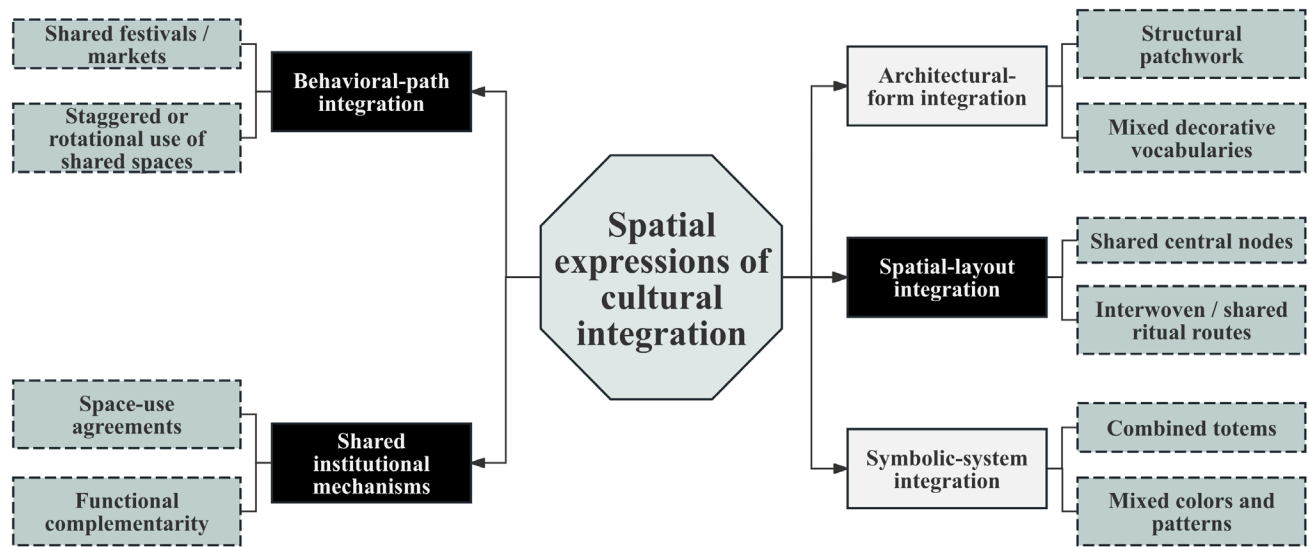


Figure 12 Spatial expressions associated with cultural integration in ethnic settlements: an evidence-informed synthesis of five recurrent pathways in the reviewed studies.

3.4 T3 Settlement Typology and Comparability

Typological studies provide a meso-level lens for comparing recurrent relations among spatial interaction, spatial expression, and settlement organization. Rather than only cataloging morphological variation, this line of work asks which spatial, behavioral, and cultural features tend to recur together in recognizable settlement forms and whether such patterns can support comparison across cases (Duan et al., 2023; Luo et al., 2025). In this sense, typology functions less as a fixed classification system than as a comparative device for organizing recurring settlement patterns.

Across the reviewed China-context literature, typological schemes are commonly organized along three dimensions: spatial form and geographic setting (e.g., plateau-mountain-plain contrasts), social structure and ethno-cultural attributes (e.g., religion-oriented, clan-network, or festival-centered types), and built environment together with behavioral logic (e.g., square-centered, linear street-alley, and courtyard-enclosed patterns) (Hu et al., 2024). These dimensions are often illustrated through regionally specific settlement traditions. In Tibetan-Qiang regions, Tibetan villages are often described through plateau stone-built forms and religious-axis logics linked to monasteries and pilgrimage routes, whereas Qiang fortress settlements are more commonly framed as mountain-terrace defensive-cluster types organized around watchtowers and defensive siting. In the Miao-Dong areas of Guizhou, settlements are frequently characterized as deliberation-

and festival-centered types organized around drum-tower squares (Sun, 2022; Li, 2024). Even so, the typological evidence remains limited. Many schemes remain relatively single-dimensional, pay limited attention to hybridity and behavioral interaction, and under-represent historical transformation.

A further limitation is that these classifications are often used as qualitative templates without being systematically tested against everyday use or cultural responsiveness. Recent studies have begun to bring in space syntax, GIS, and multi-source datasets to examine how settlement types relate to movement patterns and cultural cognition, which offers more reproducible support for typological comparison (Lai et al., 2023; Luo et al., 2025). For now, typology remains a comparatively thin but useful comparative layer, linking interaction, spatial expression, and evaluation rather than standing as a fully developed field on its own.

Following this logic, Figure 13 presents an evidence-informed radar profile across five dimensions—topographic adaptability, spatial organization, cultural expression, behavioral pathways, and symbolic systems—to illustrate how representative settlement types differ in emphasis. The core-clustered mountain village shows a stronger emphasis on topographic adaptability, the terraced-slope settlement on cultural expression and symbolic systems, and the river-valley linear village on spatial organization and behavioral pathways. The figure is intended as an analytical aid for typological comparison rather than as a measured index or a validated classification model.

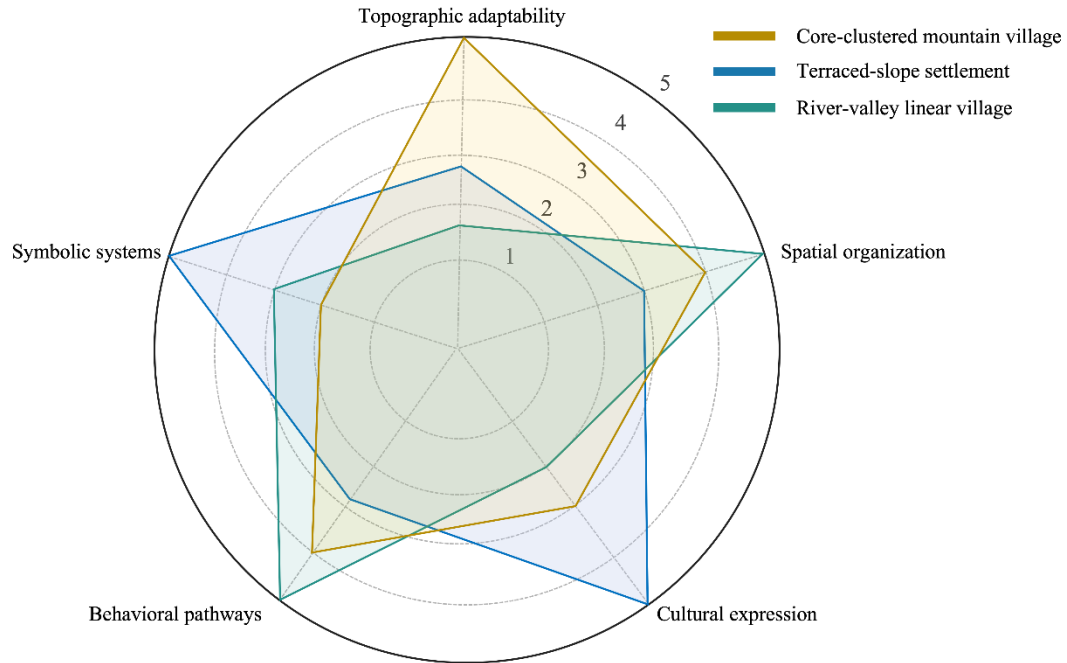


Figure 13 Evidence-informed radar profile for typological comparison across five dimensions of ethnic settlements.

Dimensions: topographic adaptability; spatial organization; cultural expression; behavioral pathways; symbolic systems.

Types: core-clustered mountain village; terraced-slope settlement; river-valley linear village.

3.5 T4 Evaluation Frameworks and Indicators

In research and planning on ethnic settlements, evaluation frameworks increasingly need to look beyond physical conditions and infrastructure so that cultural values and everyday community life are not treated as secondary concerns. However, many commonly used systems still rely on generic built-environment indicators and may fail to capture the compound space-behavior-culture logics through which ethnic settlements function. As a result, culturally specific practices and forms of behavioral adaptability can be oversimplified or misread in assessment and decision-making (Xiao et al., 2024; Petti et al., 2020; Hu et al., 2024).

Recent work has therefore called for more culturally responsive and place-based evaluation. Internationally, this direction resonates with UNESCO's Historic Urban Landscape framework and related operational tools, as well as with instruments such as the Place Standard Tool, which place greater emphasis on lived experience, participation, and place quality (UNESCO, 2011; NHS Health Scotland et al., 2015; Powell et al., 2024). Within China, related discussions likewise argue that evaluation should attend more carefully to cultural expression, continuity, and coexistence, rather than treating ethnic settlements simply as objects of standard upgrading (Yang et al., 2024; Hu et al., 2024).

Building on the literature reviewed above, and in line with the interactional, expressive, and typological patterns discussed in Sections 3.2–3.4, Table 4 is organized around three linked evaluative dimensions. One concerns spatial supportiveness, focusing on whether a settlement's spatial setting can sustain diverse forms of movement, activity, and interaction through such indicators as accessibility of key nodes and paths, connectivity, and flexibility in the use of space. A second concerns cultural sensitivity, asking whether evaluation can register cultural expression and continuity through symbolic presence in spatial form, the continuity of ritual routes, and the availability of spaces for intangible cultural practices. The third concerns community identity, addressing lived experience and participation through indicators such as place attachment, use of public space, and perceived opportunities for ethnic participation (Li et al., 2020).

In methodological terms, this framework can be worked through by combining GIS and space-syntax measures with qualitative materials such as coded interviews and community surveys, while also leaving room for participatory deliberation so that local knowledge and culturally specific claims are not filtered out by technical scoring alone (UNESCO, 2019; Petti et al., 2020; Li et al., 2020). Read in this way, the three dimensions are not proposed as a validated evaluation system, but as a working, evidence-informed framework for comparison and discussion, intended to reduce the tendency to treat ethnic settlements as form-based checklist objects.

Table 4 Three Core Dimensions of an Evaluation Framework for Ethnic Settlements.

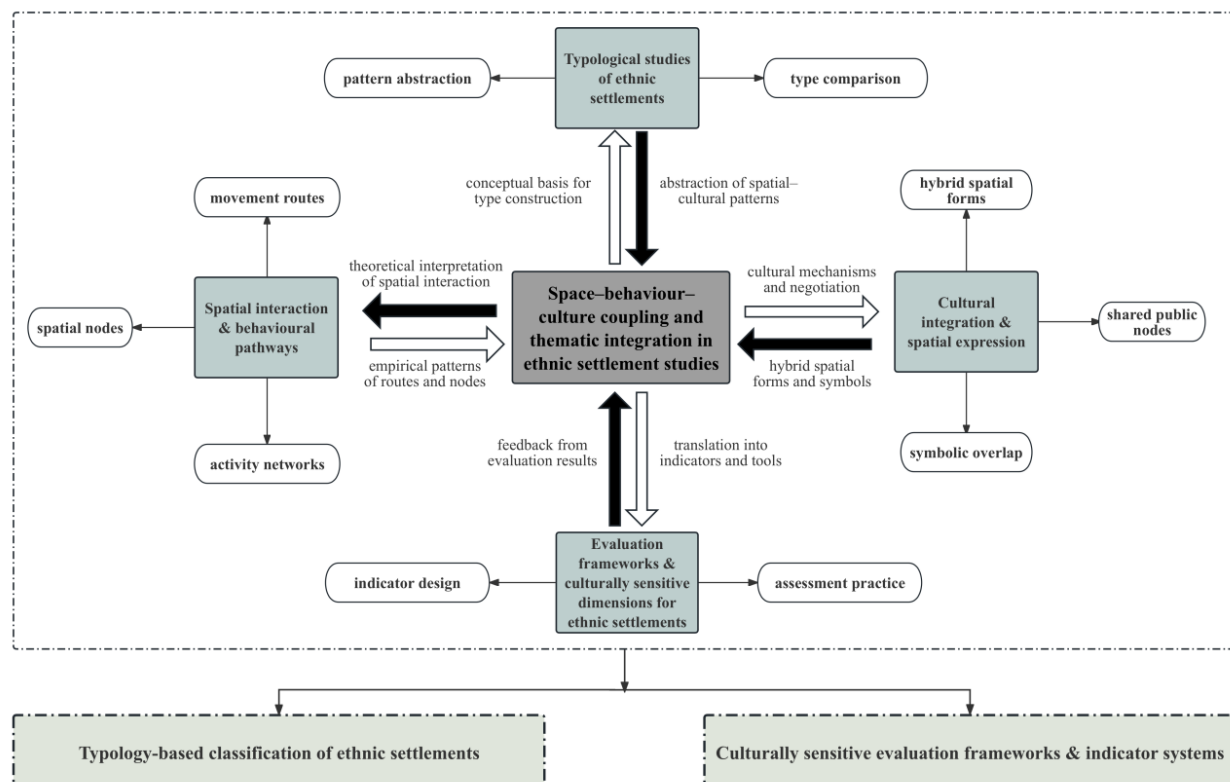
Indicator Category	Example Indicators	Evaluation Purpose
Spatial Supportiveness	Accessibility of key nodes and paths; path connectivity; flexibility in the use of space	Assess whether space supports diverse behaviors and interaction needs
Cultural Sensitivity	Symbolic presence in spatial form; continuity of ritual routes; availability of spaces for intangible cultural practices	Evaluate whether space responds to cultural expression and continuity
Community Identity	Place attachment; use of public space; perceived opportunities for ethnic participation	Considers residents' emotional attachment and their perceived scope for social participation

3.6 Integrative discussion: coupling logic, evaluation genealogy, and research agenda

3.6.1 Theoretical integration: coupling space, behavior, and culture

Figure 14 synthesizes the implications of Sections 3.2–3.5 by treating ethnic settlements as operating spatial systems in which spatial structure, everyday practice, and cultural meaning are closely intertwined. Within this framework, the four thematic strands remain distinct in emphasis but connected in analytical logic. Studies of spatial interaction and

behavioral pathways identify the node-route conditions through which encounter, circulation, and recurring co-use become spatially organized. Research on cultural integration and spatial expression shows how these relations become materially and symbolically visible through shared nodes, hybrid spatial forms, symbolic overlap, and negotiated routines. Typological studies extend this logic to a meso-level of comparison by condensing recurrent combinations of space, behavior, and cultural expression into more comparable settlement labels. Work combining space syntax with culturally inflected spatial variables has begun to provide clearer and more reproducible support for typological comparison across cases (Lai et al., 2023). Evaluation frameworks reorganize these linked findings into more operational dimensions and criteria, while participation- and lived-experience-oriented approaches provide a practical basis for incorporating local knowledge into assessment systems (Li et al., 2020).

**Figure 14** Conceptual framework of space-behavior-culture coupling and thematic integration in ethnic settlement studies.

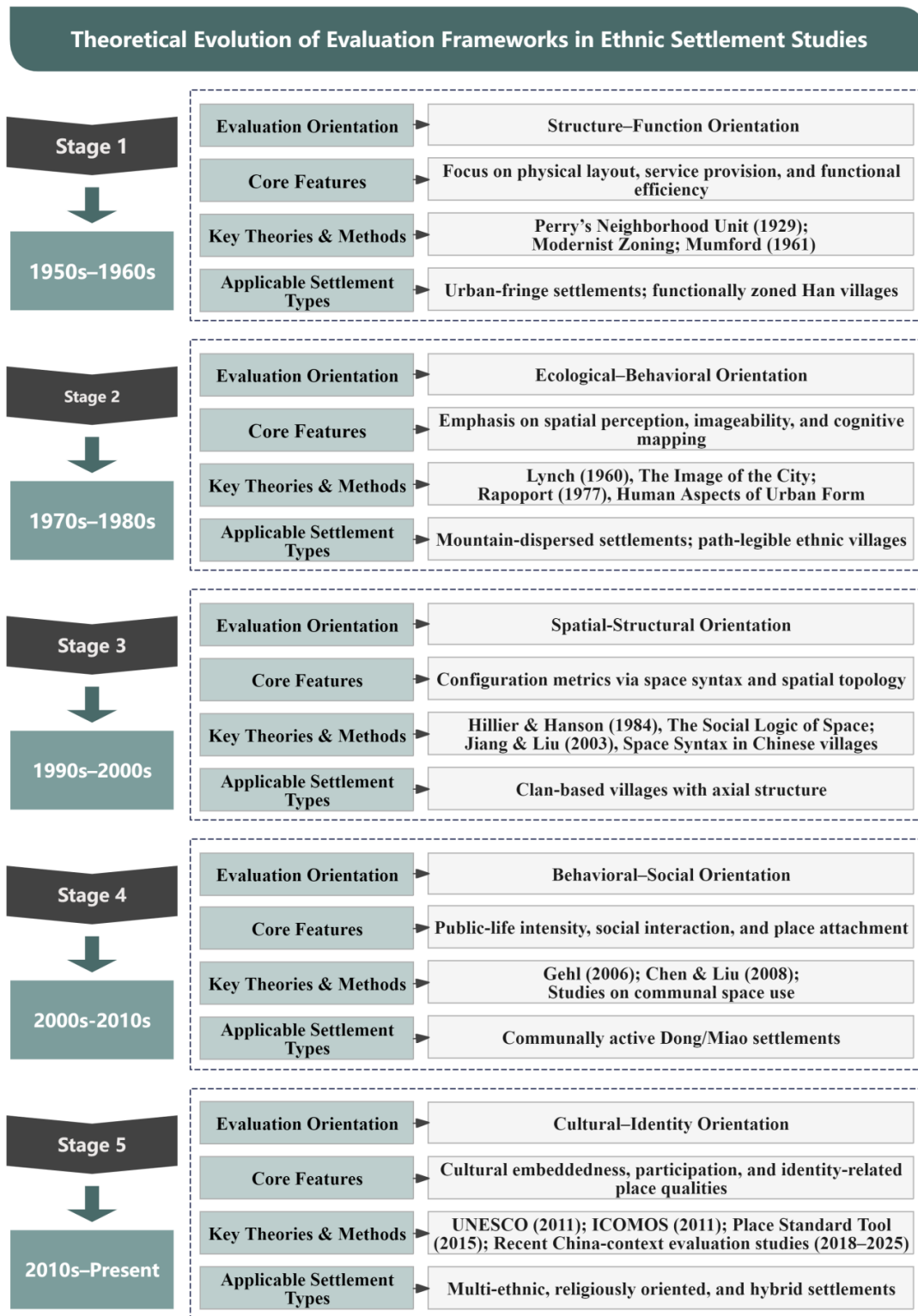


Figure 15 Genealogy of evaluation orientations in ethnic-settlement studies: a five-stage heuristic synthesis.

3.6.2 Evaluation genealogy: paradigm shifts and usable lineages

Figure 15 outlines an evidence-informed heuristic reconstruction of evaluation orientations in ethnic-settlement

studies, showing a long-run shift from structure-function concerns toward approaches that increasingly foreground behavior, perception, culture, and identity. Stage 1 (1950s–1960s) focused mainly on measurable layout and service indicators, such as accessibility, density, land-use efficiency, and

infrastructure provision. Stage 2 (1970s-1980s) introduced ecological-behavioral concerns through perception and cognitive mapping, with greater attention to legibility and everyday navigation. Stage 3 (1990s-2000s) strengthened spatial-structural evaluation through space syntax and topology, linking configuration to movement and interaction through indices such as integration, choice, and connectivity. Stage 4 (2000s-2010s) placed greater emphasis on everyday public life and communal practice through behavioral-social indicators, including frequency of use, interaction intensity, and place

3.6.3 Synthesis-derived research directions

Future evaluation needs to move beyond physical condition alone and address more directly whether spatial settings still support everyday practice, shared use, and cultural continuity. It also needs a more traceable evidential structure, one that connects spatial analysis, observed or inferred patterns of use, and resident-based accounts more explicitly, rather than relying on a single type of measure.

Three tasks follow. First, evaluation needs a two-level structure: a relatively stable comparative layer across cases and a second, more flexible layer in which sub-indicators and weighting can respond to local conditions. Second, studies need to show more clearly how different forms of evidence are connected, so that interpretive steps remain visible and open to review. Third, if negotiated evaluation is taken seriously, the procedure itself has to be specified more clearly, including who participates, when they enter the process, and how disagreement is recorded and handled.

4. Conclusion

This review examined how existing scholarship addresses spatial interaction and cultural integration in ethnic settlements. Relevant studies have developed across geography, anthropology, architecture, and planning, but they remain uneven in thematic focus, evidential depth, and standards of comparison. Available evidence is concentrated mainly in studies of interaction and behavior, while work directly focused on typology and cultural integration remains relatively limited.

On the basis of the reviewed literature, a cautious conclusion is that spatial interaction and cultural integration are often discussed within the same frame, but not on the same evidential basis. Interaction is usually examined more directly, often through observable conditions such as routes, nodes, accessibility, and recurring co-use; cultural integration, by contrast, is more often inferred from indirect signs. What is still missing is a directly comparable synthesis that separates observable interaction, interpretive indicators, and stronger claims about cultural integration. To make it more directly comparable, this review clarifies what is examined, how it is examined, and what kinds of claims can be compared across studies, thereby providing a clearer basis for interpretation and a more focused basis for evaluation in planning and conservation.

attachment. Stage 5 (2010s-present) consolidated a stronger cultural-identity orientation, shaped by cultural landscape and heritage debates and by tools incorporating cultural embeddedness, participation, and identity-related place qualities. These five stages can be regrouped into three partly overlapping strands—structure-function, behavior-perception, and culture-identity—clarifying the main evaluative orientations carried forward into current discussions of ethnic-settlement assessment.

This review also has limits. Database coverage is uneven, reporting depth varies considerably, and the evidential base remains unbalanced across the field. Future research needs broader comparative sampling and more targeted testing in representative settlement types, especially where research is expected to inform intervention.

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Conflicts of Interests

The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper.

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